

**What is claimed is:**

1           1.    A receiving method for a dual-mode receiver,  
2    the method characterized in that:  
3           when a received communication signal is a wideband  
4                signal, the dual-mode receiver is configured as  
5                a direct-conversion receiver; and  
6           when a received communication signal is a narrowband  
7                signal, the dual-mode receiver is configured as  
8                a low-IF receiver.

1           2.    The method of claim 1, wherein receipt of a  
2    communication signal by a direct-conversion mode further  
3    comprises:  
4           receiving an input signal with a carrier;  
5           amplifying the input signal;  
6           converting the amplified signal down to baseband  
7                signals, wherein the baseband signals comprise  
8                an I-channel signal and a Q-channel signal;  
9           canceling DC offsets of the I-channel signal and the  
10               Q-channel signal; and  
11          filtering and amplifying the signals without DC  
12               offsets to generate a pair of signals output.

1           3.    The method of claim 1, wherein receipt of a  
2    communication signal by a low-IF mode organized further  
3    comprises:  
4           receiving an input signal with a carrier;  
5           amplifying the input signal;  
6           converting the amplified signal down to intermediate  
7                frequency signals, wherein the intermediate

8 frequency signals comprise an I-channel signal  
9 and a Q-channel signal;  
10 canceling DC offsets and image of the I-channel  
11 signal and the Q-channel signal;  
12 filtering and amplifying the signals without DC  
13 offsets and image to generate a pair of  
14 signals; and  
15 converting the pair of signals down to baseband  
16 signals output, wherein the baseband signals  
17 comprise a second I-channel signal and a second  
18 Q-channel signal.

1 4. A dual-mode receiver, comprising:  
2 an antenna for receiving an input signal with a  
3 carrier from a transmitting channel;  
4 a low noise amplifier coupled to the antenna, for  
5 amplifying the input signal;  
6 a quadrature mixer coupled to the low noise  
7 amplifier, for receiving an amplified signal  
8 and two local oscillator signals respectively  
9 with a first phase and a second phase, wherein  
10 when the dual-mode receiver operates in a  
11 direct-conversion mode, the quadrature mixer  
12 converts the amplified signal down to a pair of  
13 first baseband signals and when the dual-mode  
14 receiver operates in a low-IF mode, the  
15 quadrature mixer converts the amplified signal  
16 down to a pair of second intermediate frequency  
17 signals with the carrier whose frequency is a  
18 first frequency;

19 a pair of dual-mode filters coupled to the mixer,  
20 wherein when the dual-mode receiver operates in  
21 the direct-conversion mode, the dual-modes  
22 filters are a pair of low pass filters and when  
23 the dual-mode receiver operates in the low-IF  
24 mode, the dual-modes filters are a pair of  
25 poly-phase filters;  
26 a pair of programmable gain amplifiers respectively  
27 coupled to the dual-mode filters, wherein when  
28 the dual-mode receiver operates in the direct-  
29 conversion mode, the programmable gain  
30 amplifiers receive first baseband signals to  
31 generate a pair of first signals output and  
32 when the dual-mode receiver operates in the  
33 low-IF mode, the programmable gain amplifiers  
34 receive the second intermediate frequency  
35 signal signals to generate a pair of second  
36 signals output;  
37 a secondary downconverter, wherein when the dual-  
38 mode receiver operates in the low-IF mode, the  
39 secondary downconverter receives the second  
40 signals and a second local oscillator signal,  
41 and converts the second signals to a pair of  
42 third baseband signals output; and  
43 a pair of switching elements for connecting the  
44 programmable gain amplifiers to the secondary  
45 downconverter when the dual-mode receiver  
46 operates in the low-IF mode.

1        5.    The dual-mode receiver of claim 4, wherein the  
2 dual-mode receiver further comprises:

3        a local oscillator for generating a local oscillator  
4            signal with the first phase, a local oscillator  
5            signal with the second phase and a second local  
6            oscillator signal;

7        a digital signal processor, wherein when the dual-  
8            mode receiver operates in the direct-conversion  
9            mode, the digital signal processor receives the  
10           first signals to generate data information  
11           output and when the dual-mode receiver operates  
12           in the low-IF mode, the digital signal  
13           processor receives the third signals to  
14           generate data information output; and

15       a pair of switching elements for connecting the  
16           programmable gain amplifiers to the digital  
17           signal processor when the dual-mode receiver  
18           operates in the direct-conversion mode.

1        6.    The dual-mode receiver of claim 4, wherein the  
2 first phase and the second phase are respectively 90° and  
3 0°.

1        7.    The dual-mode receiver of claim 4, wherein the  
2 secondary downconverter is implemented with an analog  
3 circuit.

1        8.    The dual-mode receiver of claim 7, further  
2 comprising an analog-to-digital converter coupled after  
3 the secondary downconverter.

1           9.    The dual-mode receiver of claim 4, wherein the  
2   secondary downconverter is implemented with a digital  
3   circuit.

1           10.   The dual-mode receiver of claim 9, further  
2   comprising an analog-to-digital converter coupled between  
3   the secondary downconverter and the programmable gain  
4   amplifiers.

1           11.   A dual-mode receiver, comprising:  
2        an antenna for receiving an input signal with a  
3                carrier from a transmitting channel;  
4        a low noise amplifier coupled to the antenna, for  
5                amplifying the input signal;  
6        a quadrature mixer coupled to the low noise  
7                amplifier, for receiving an amplified signal  
8                and two local oscillator signals respectively  
9                with a first phase and a second phase, wherein  
10       when the dual-mode receiver operates in a  
11       direct-conversion mode, the quadrature mixer  
12       converts the amplified signal down to a pair of  
13       first baseband signals and when the dual-mode  
14       receiver operates in a low-IF mode, the  
15       quadrature mixer converts the amplified signal  
16       down to a pair of second intermediate frequency  
17       signals with the carrier whose frequency is a  
18       first frequency;  
19       a pair of low pass filters coupled to the mixer,  
20               wherein when the dual-mode receiver operates in  
21       the direct-conversion mode, the low pass

22 filters receive the first baseband signals and  
23 when the dual-mode receiver operates in the  
24 low-IF mode, the low pass filters receive the  
25 second intermediate frequency signals;  
26 a pair of programmable gain amplifiers respectively  
27 coupled to the dual-mode filters, wherein when  
28 the dual-mode receiver operates in the direct-  
29 conversion mode, the programmable gain  
30 amplifiers receive first baseband signals to  
31 generate a pair of first signals output and  
32 when the dual-mode receiver operates in the  
33 low-IF mode, the programmable gain amplifiers  
34 receive the second intermediate frequency  
35 signal signals to generate a pair of second  
36 signals output;  
37 a quadrature secondary downconverter, wherein when  
38 the dual-mode receiver operates in the low-IF  
39 mode, the secondary downconverter receives the  
40 second signals and two second local oscillator  
41 signals respectively in the first phase and the  
42 second phase, and converts the second signals  
43 to a pair of third baseband signals output; and  
44 a pair of switching elements for connecting the  
45 programmable gain amplifiers to the quadrature  
46 secondary downconverter when the dual-mode  
47 receiver operates in the low-IF mode.

1 12. The dual-mode receiver of claim 11, wherein the  
2 dual-mode receiver further comprises:

3       a local oscillator for generating the local  
4           oscillator signal with the first phase, the  
5           local oscillator signal with the second phase,  
6           the second local oscillator signal with the  
7           first phase and the second local oscillator  
8           signal with the second phase;  
9       a digital signal processor, wherein when the dual-  
10           mode receiver operates in the direct-conversion  
11           mode, the digital signal processor receives the  
12           first signals to generate data information  
13           output and when the dual-mode receiver operates  
14           in the low-IF mode, the digital signal  
15           processor receives the third signals to  
16           generate data information output; and  
17       a pair of switching elements for connecting the  
18           programmable gain amplifiers to the digital  
19           signal processor when the dual-mode receiver  
20           operates in the direct-conversion mode.

1       13. The dual-mode receiver of claim 11, wherein the  
2       first phase and the second phase are respectively  $90^\circ$  and  
3        $0^\circ$ .

1       14. The dual-mode receiver of claim 11, wherein the  
2       quadrature secondary downconverter is implemented with an  
3       analog circuit.

1       15. The dual-mode receiver of claim 14, further  
2       comprising an analog-to-digital converter coupled after  
3       the quadrature secondary downconverter.

1           16. The dual-mode receiver of claim 11, wherein the  
2 quadrature secondary downconverter is implemented with a  
3 digital circuit.

1           17. The dual-mode receiver of claim 16, further  
2 comprising an analog-to-digital converter coupled between  
3 the quadrature secondary downconverter and the  
4 programmable gain amplifiers.